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IN VIVO MEASUREMENT OF THE 3D ORIENTATION OF LEFT VENTRICULAR OUTFLOW TRACT USING A VALVULOPLASTY BALLOON WITH RADIO-OPAQUE MARKERS: A LARGE ANIMAL PROOF-OF-CONCEPT EXPERIMENT

Poster Contributions

Poster Sessions, Expo North

Sunday, March 10, 2013, 3:45 p.m.-4:30 p.m.

Session Title: Preclinical and Translational Research

Abstract Category: 49. TCT@ACC-i2: Aortic Valve Disease

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Background: For TAVR procedures, simple, rapid, reliable prediction of 3D orientation of the anatomy may help determine the optimal x-ray projection angle for valve deployment.

Methods: A custom balloon and analytical method based on x-ray images were developed to measure the 3D angular orientation of cardiovascular anatomy. Radio-opaque markers were added to the body of a valvuloplasty balloon. The markers were arranged to form two rings of 6 markers each around the circumference of the balloon. The balloon was inflated in the LVOT across the aortic valve of a 35 kg pig and a single PA projection image acquired. Using the location of the marker shadows from the x-ray image as input, the analytical method measured the 3D angular orientation of the balloon in-vivo. The 3D orientation was used to calculate the continuous range of left-right (LR) and cranial-caudal (CC) angles that provide perpendicular x-ray projections. The accuracy of the method was verified experimentally for LR angles in the range -90 to 90 degrees (45 degree increments). For each LR angle, the CC angle was set to that predicted by the analytical method; the marker balloon was inflated; and x-ray images acquired and analyzed.

Results: Analysis of images indicated an average x-ray projection error of 3.6 degrees (range 1.8 to 5.8 degrees). The relative contribution of error from the analytical method, replication of balloon position, and from cardiac motion is unknown.

Conclusions: Using this analytical methodology, the 3D angular orientation of cardiovascular structures can be calculated from a single image of a balloon which includes 2 rings of radio-opaque markers, which may be useful in TAVR positioning and deployment.